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Measuring Magnetic Field Tangling Using the Topological Entropy

Like two-dimensional time periodic flows, three-dimensional periodic magnetic fields induce a tangling of material lines. Such tangling can be generated by a magnetic field line twist or braid and have important ramifications for the solar magnetic field. One measure of such mixing is the so called finite time topological entropy FTTE. Similar to the finite time Lyapunov exponent it quantifies the amount of mixing of the fluid or chaotic dynamics in the system. Here we present an efficient method on how to compute the FTTE for periodic magnetic fields, like in Tokamaks, or for solar magnetic fields. Our method is both precise and highly time efficient. To show case the method we apply it to such cases that describe tangled or twisted magnetic fields.